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two new instrumental techniques that show great promise for low level analysis: Triple Quadrupole Mass Spectrometry (TQMS) and Micell Stabilized Room Temperature Phosphorescence (MS-RTP).

Often, 2,3,7,8 - TCDD is not always the major contaminant in a dioxin mixture, nor is it the only toxicant. A source such as pentachlorophenol (a fungicide and wood preservative) contains significant levels of hexa-, hepta-, and octachloro dibenzodioxins (PCDD's) and very little 2,3,7,8-TCDD. This is also true of incinerators which contain chlorophenols. In determining the bioavailability of dioxins in the food chain, it is important todetermine the source of the contaminants in the environment, as well as, to follow the degradation of the dioxins in the environment. It would also be of interest to see which isomers were most prevalent in biological samples. For this, a technique should be developed which measures not only 2,3,7,8 - TCDD, but includes other PCDD isomers, and dibenzofurans (PCDF's) which are often found with dioxin residues. Quantification of PCDD and PCDF levels may add valuable information in determining the bioavailability of dioxins in the food chain. Different sources produce distinct mixtures of isomers of PCDD's and PCDF's.

The TQMS research will provide important information about the applicability of TQMS for profiling analyses and will establish whether conditions can be developed that provide a cheaper and better dioxin analysis technique than can be obtained by conventional gas chromatography-mass spectrometry (GC-MS) procedures. We would also like to provide technique which is isomer specific. If it is possible to perform direct analyses on unprocessed or minimally processed samples with the same or better precision and reliability as capillary GC-MS, a most significant breakthrough in technology will have been demonstrated.

The MS-RTP studies will investigate the applicability of a selective optical method for the qualitative and quantitative analyses of dioxins. This will be accomplished through the determination of the complete room temperature phosphorescence spectra of various dioxins and the time resolved spectra of these same compounds. The data will then be used to unambiguously identify the constituents of chromatograms which will have been developed by an aqueous micellar mobile phase. If this selective detection system can be developed, characterization of dioxins in non-phosphorescing matrices will be greatly simplified.

If development of these techniques is rapid enough, it may be possible to follow up the preliminary studies and make new and better measurements of dioxin residues in fish. The

decreased time and cost will allow a larger and more systematic sample to be analyzed and will thus provide a cleaner picture of the distribution of dioxins in Great Lakes fish. This information can be used to protect the integrity of the food chain and human health. Although the above investigations are aimed specifically at 2,3,7,8-TCDD, the analytical improvements which are expected will likely be applicable to other substances of concern such as dibenzofurans and polychlorinated biphenyls (PCB's) and other dioxin isomers. Many of these are similar to dioxins in both properties and toxic effects, and may also be significant environmental and food chain contaminants.

PROGRESS: Progress thus far is as follows:

1. TQMS - We have completed the initial phases involving the collection of normal mother ion spectra for all 22 of the tetra congeners and for selected penta, hexa, hepta, and octachloro dioxin isomers. Work has progressed on the use of internal standards on the capillary GC-TQMS system so as to give unambiguous retention time indicies for the various dioxin isomers and for the toxaphene components. We are now in the process of evaluating the optimal reagent gas to be used in the center stage of the TQMS so as to give CAD ions with the greatest discrimination between the various isomers. We have set up a valved system for the clean up of dioxin samples as the first step toward automation of the entire process through computer control.

2. MS-RTP - Progress to date has mainly concentrated on the on the completion of the instrumental design, computer interfaces and computer programs necessary to drive the instrument and collect data. The spectrograph containing a flat field holographic grating and intensified diode array (250 mm span) has been integrated to a microprocessor and program written in Forth have been developed. In addition, the AB-SPF fluorometer has also been coupled to the microprocessor so that a completely integrated system is now operational. In addition, the HPLC parameters for the MS-RTP separation for a number of dioxins as well as potential interferences (DDT complex, PCB's, phenols, etc.) have been developed. The development of a spark-source time resolved system has also been completed.

STATUS OF INVENTIONS: None

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